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COMPARISON OF PERFORATED DUODENAL REPAIR OPEN VS LAPAROSCOPIC AND NATURE OF COMPLICATIONS

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Abstract

Objective:
To compare the outcomes of laparoscopic versus open surgical procedures in patients with perforated duodenal ulcers.

Study Design: *Prospective observational study.*

Place and Duration of Study: *Department of Surgery, CMH Quetta from Oct 2024 to March 2025*

Methodology:
This prospective observational study was conducted and included adult patients (≥18 years) diagnosed with perforated duodenal ulcers, confirmed preoperatively by imaging or intraoperatively during exploration. A total of 73 patients were enrolled based on a 5% prevalence rate. Patients were divided into two groups: Group A, which underwent open surgical duodenal repair, and Group B, which underwent laparoscopic duodenal repair. Patients eligible for either surgical approach were included. Demographic data, clinical variables, operative details, and postoperative outcomes were recorded and analyzed using SPSS version 26.0. Chi-square and independent t-tests were applied to compare variables between the two groups, with a p-value ≤0.05 considered statistically significant.

Results:
The mean age was 52.22± 2.22 years, with no significant difference between Group A (54.53 years) and Group B (47.98 years). Males comprised 58.9% of patients, and comorbidities were present in 72.6%. Proton pump inhibitor use was higher in Group B (91.78%). Boey scores were significantly lower in Group B (0.7) compared to Group A (1.5) (p=0.04). Group B had smaller ulcer sizes (6.9 mm), shorter operative time (108 minutes), and lower postoperative morbidity (19.51%) compared to Group A (40.63%). ICU requirement was higher in Group A. Mortality rates and length of hospital stay were comparable between groups.

Conclusion:
Laparoscopic repair is a safe and effective treatment modality for perforated duodenal ulcers, offering reduced morbidity and operative time compared to open repair.

INTRODUCTION:

The management of perforated Duodenal Ulcer remains a critical aspect of emergency surgery due to their high morbidity and mortality rates. [1]. Duodenal ulcer disease annually affects four million individuals across the globe [2]. The prevalence of Duodenal ulcer disease rnges between 1.5% and 3%, While complications may arise in 10-20% of patients with Duodenal ulcer disease, acute illnesses are caused by ulcer perforation in only 2-14% of cases [3]. Despite advances in medical and surgical interventions, the mortality rate associated with PUD perforations remains substantial [4], ranging from 10% to 40% [5], with a considerable impact on in-hospital mortality rates, which range from 5% to 24% [6-8].

Regarding the surgical management of perforated Duodenal ulcers, several clinical trials [9,10,11] have demonstrated that the laparoscopic approach yielded favorable results in terms of reduced postoperative pain, abbreviated hospital stays, and earlier resumption of regular patient activities. However, there is ongoing debate regarding the superiority of the laparoscopic approach in terms of morbidity, mortality, and reoperation rates.

Existing meta-analyses have reported conflicting results regarding the outcomes of laparoscopic repair compared to open repair for PPUs. Except for the lower rate of surgical site infection, published meta-analyses [12,13] demonstrated that laparoscopic repair was associated with comparable rates of postoperative surgical complications. In addition, Antoniou et al. [14] concluded that the existing body of evidence does not unequivocally establish the benefits of laparoscopic repair over open repair for any of the outcomes assessed in their meta-analysis. Laparoscopic repair for perforated Duodenal ulcer was associated with a shorter total hospital stay and decreased morbidity in comparison to the open approach, according to another meta-analysis [15]. However, no significant disparities were found in terms of mortality, post-operative sepsis, abscess, or re-operation rates.

Considering the inconsistencies in the literature and the ongoing debate over the best surgical approach for perforated Duodenal ulcers, it is crucial to conduct additional research and thoroughly analyze the outcomes of laparoscopic versus open repair. This study seeks to enhance the current knowledge by conducting a thorough analysis of postoperative outcomes, such as morbidity, mortality, hospital stay, and reoperation rates. The goal is to offer a more conclusive evaluation of the advantages and disadvantages of each surgical approach. Our goal is to fill in these knowledge gaps so that we can provide valuable insights for clinical practice and improve patient outcomes in the treatment of perforated Duodenal ulcers. The objective of this study was to examine the outcomes of laparoscopic and open surgical procedures in 73 consecutive patients with perforated duodenal ulcers.

Materials and Methods

We conducted a prospective observational at a gastroenterology department of CMH Quetta over Oct 2024 to March 2025, involving patients presenting with perforated duodenal ulcers who require surgical intervention at our department. The study was adult patients (age ≥ 18 years) diagnosed with perforated duodenal ulcers confirmed either preoperatively through imaging studies or intraoperatively during surgical exploration.

The inclusion criteria involved Patients diagnosed with perforated duodenal ulcers and scheduled to undergo either open or laparoscopic repair.

Patients with contraindications to surgery or general anesthesia and severe comorbidities were excluded.

The sample size calculation was determined considering a 5% prevalence of duodenal perforations [3], with a statistical power of 80% and a significance level of 0.05. Consequently, the required sample size for the study was determined to be 73 patients. Demographic information, medical history, presenting symptoms, laboratory findings, imaging results (plain X-ray, computed tomography), and severity of the disease (Boey score) were assessed and documented preoperatively. The Boey score, which is employed to assess the severity of the disease, is calculated using the information about the subsequent three criteria: shock upon admission (systolic blood

pressure below 90 mm Hg), severe medical illness (ASA III–V), and delayed presentation (symptom duration exceeding 24 hours). By this scoring system, the patient is awarded a single point for each affirmative criterion, ranging from zero to three. Depending on the consulting surgeon's discretion, laparoscopy or laparotomy was performed on patients who obtained a Boey score between 0 and 2. For laparotomy consideration, patients obtained a Boey score of 3 [16].

Data regarding the surgical approach (open or laparoscopic), operative duration, intraoperative complications, and the type of repair conducted will be collected. Additionally, data on postoperative complications such as surgical site infections, abscess formation, anastomotic leaks, bleeding, etc., along with the length of hospital stay, instances necessitating reoperation, and mortality rates will be documented.

The study protocol was reviewed and approved by the Institutional Review Board (IRB) or Ethics Committee of CMH Quetta. Informed consent was obtained from all study participants before enrollment in the study.

The data analysis was conducted using SPSS V 26. and the significance level was set at $P < 0.05$. We utilized descriptive statistics to summarize the demographic and clinical characteristics. Continuous variables were presented as mean (± standard deviation), while categorical variables were expressed as frequency (percentage). Group comparisons for continuous variables were conducted using independent t-tests. Chi-square tests or Fisher's exact tests were used to analyze categorical variables and determine any differences between the laparotomy and open surgery groups.

Results:

Among the study sample of 73 patients, 41 (56.16%) patients in the laparotomy group and 32 (43.84%) in the open group, showed comparable demographic and clinical characteristics. The mean age in the laparotomy group was 47.98 years (±14.21) and 54.53 years (±20.31) in the open group, resulting in an overall mean age of 52.22 years (±19.95), with no significant difference observed ($P = 0.09$). Gender distribution indicated 58.53% males in the laparotomy group and 59.37% in the open group, contributing to an overall male percentage of 58.90%. Common comorbidities were present in 70.73% of laparotomy patients and 75% of open surgery patients, with an overall prevalence of 72.6%. Notably, proton pump inhibitor (PPI) treatment rates were higher in the laparotomy group at 95.12% compared to 87.5% in the open group, resulting in an overall PPI treatment rate of 91.78% ($P = 0.04$). Smoking status differed slightly between groups, with 53.66% of laparotomy patients and 46.88% of open surgery patients being smokers, contributing to an overall smoking rate of 50.68% ($P = 0.03$). Previous abdominal surgery and preoperative delay showed no significant differences between the groups. Boey scores, indicating the severity of the condition, were lower in the laparotomy group (mean ± SD = 0.7 ± 0.5) compared to the open group (mean ± SD = 1.5 ± 0.9), resulting in an overall Boey score of 1.05 (±0.8), with a significant difference observed ($P = 0.04$).

Table I: Demographic and clinical characteristics of the study sample

Variables	Laparotomy group (41)	Open Group (32)	Overall (73)	P value
Age mean (± SD)	47.98 (±14.21)	54.53 (±20.31)	52.22 (19.95)	0.09
Gender n (%)				1.56
Male	24 (58.53)	19 (59.37)	43 (58.90)	
Female	17 (41.46)	13 (40.62)	30 41.10	
Comorbidities n (%)	29 (70.73)	24 (75)	53 (72.6)	0.83
PPI treatment, n (%)	39 (95.12)	28 (87.5)	67 (91.78)	**0.04***

Smoking status, n (%)	22 (53.66)	15 (46.88)	73 (50.68)	**0.03***
Previous abdominal surgery, n (%)	14 (34.15)	12 (37.5)	26 (35.62)	0.43
Preoperative delay (hs) mean (± SD)	52 (±12.59)	59 (±9.64)	55.07 (±5.71)	0.12
Boey score mean (± SD)	0.7 (±0.5)	1.5 (±0.9)	1.05 (±0.8)	**0.04***

*= Significant differences= P< 0.05

The intraoperative findings revealed significant differences between patients undergoing laparotomy and open surgery for perforated Duodenal ulcers. The mean ulcer size was notably smaller in the laparotomy group at 6.9 mm (±4.01) compared to 14.8 mm (±10.28) in the open group, with an overall mean of 10.37 mm (±7.43) across all patients (P = 0.00). Ulcer location analysis indicated a higher prevalence of anterior ulcers, accounting for 97.56% in the laparotomy group, 90.63% in the open group, and 94.52% overall, whereas posterior ulcers were less common (P = 0.00*). Surgical procedures demonstrated that 90.24% of laparotomy patients underwent suture with omentopexy, compared to 81.25% in the open group, resulting in an overall rate of 86.30% (P = 0.09). Moreover, the mean operative time was significantly shorter in the laparotomy group (108 min ±17.82) compared to the open group (199 min ±20.12), with an overall mean of 147.95 min (±18.86) for all patients (P = 0.00). These findings highlight distinct intraoperative characteristics and surgical approaches between the two groups, influencing treatment strategies and outcomes for perforated Duodenal ulcers (Table 2.)

Table II: Intraoperative differences between groups

Variables	Laparotomy group (41)	Open Group (32)	Overall	P value
Ulcer size, mean (± SD)	6.9 (±4.01)	14.8 (±10.28)	10.37 (±7.43)	**0.00***
Ulcer location, n (%)				**0.00***
Anterior	40 (97.56)	29 (90.63)	69 (94.52)	
Posterior	1 (2.44)	3 (9.38)	4 (5.48)	
Surgical procedures, n (%)				0.09
Suture with omentopexy	37 (90.24)	26 (81.25)	63 (86.30)	
Omentopexy only	4 (9.76)	0	4 (5.48)	
Operative time, min, mean (± SD)	108 (±17.82)	199 (±20.12)	147.95 (±18.86)	**0.00***

*= Significant differences= P< 0.05

The postoperative comparisons between the laparotomy group (41 patients) and the open group (32 patients) revealed several noteworthy findings. In-hospital morbidity was significantly lower in the laparotomy group at 19.51% compared to 40.63% in the open group, with an overall morbidity rate of 28.77% (P = 0.00*). Re-intervention rates were 9.76% in the laparotomy group and 18.75% in the open group, contributing to an overall rate of 13.70%, although this difference was not statistically significant (P = 0.09). Similarly, in-hospital mortality was lower in the laparotomy group at 4.88% compared to 15.63% in the open group, resulting in an overall mortality rate of 9.59%, which did not reach statistical significance (P =

0.10). However, the need for ICU care was significantly higher in the open group at 21.88% compared to 12.20% in the laparotomy group, with an overall ICU need of 16.44% (P = 0.01*). Interestingly, the mean ICU stay and postoperative stay did not show significant differences between the groups (P > 0.05). These findings suggest that while in-hospital morbidity and ICU need differ significantly between laparotomy and open surgery for perforated Duodenal ulcers, other outcomes such as re-intervention, mortality, and length of stay exhibit comparable trends between the two surgical approaches (Table 3.)

Table III: Postoperative comparisons between groups

Variables	Laparotomy group (41)	Open Group (32)	Overall	P value
In-hospital morbidity, n (%)	8 (19.51)	13 (40.63)	21 (28.77)	**0.00***
Re-intervention, n (%)	4 (9.76)	6 (18.75)	10 (13.70)	0.09
In-hospital mortality, n (%)	2 (4.88)	5 (15.63)	7 (9.59)	0.10
ICU need, n (%)	5 (12.20)	7 (21.88)	12 (16.44)	**0.01***
ICU stay, days mean (± SD)	3.1 (±5.21)	5.9 (±12.05)	4.33 (8.87)	0.78
Postoperative stay, days, mean (± SD)	8 (±6.92)	12 (±8.16)	9.75 (±7.84)	0.56

*= Significant differences= P< 0.05

Discussions

Our findings support previous research indicating that laparoscopy is associated with reduced morbidity rates, lower mortality, and shorter postoperative hospital stays. It has been quite challenging to determine the most accurate surgical approach for PPUs, considering their low incidence in the general population [17]. Nevertheless, it has been shown that laparoscopy is a secure, viable, and efficient method for PPUs, as long as there are no contraindications [18,19]. Diverse approaches to the principal surgical technique for repairing PPUs have been documented in the literature, prompting debate [20].

For the treatment of PPUs, numerous studies, including randomized controlled trials and meta-analyses, have outlined the benefits of laparoscopic repair over an open approach [21]. Six randomized controlled trials involving 319 patients who underwent laparoscopic repair and 312 patients who underwent open repair were included in a recent meta-analysis [15]. Technical difficulties (9.4%), the extent of the perforation (57.1%), extensive peritoneal adhesions (21.4%), hemodynamic instability (17.9%), or the inability to locate the site of the perforation (7.1%) were cited as reasons why LR patients required a conversion. In contrast to the OR group, the LR group exhibited a notable reduction in overall morbidity (8.9 vs. 17%) and wound infection rate (2.2 vs. 6.3%). However, no significant disparities were observed in intraoperative abscesses (1.7% vs. 1.7%), postoperative leakage (1.1 vs. 0.3%), postoperative sepsis (0.8 vs. 0.5%), postoperative ileus (0.6 vs. 1.4%), incisional hernia (0% vs. 6%), re-operation rate (1.1 vs. 0.5%), or mortality rate (1 vs. 1.4%). In addition, the duration of hospitalization for patients undergoing LR was considerably reduced. Therefore, based on the authors' findings, laparoscopic intervention should be regarded as the preferred method of treating PPUs [15]. Nevertheless, patients who necessitated conversion to an open approach were not specifically considered in this research, as they were incorporated into the LR group. This

oversight may have introduced a potential bias into the findings. Consistent with the findings of Quah et al., [15] our analysis revealed that morbidity was considerably reduced in the LG group in comparison to the CG and OG groups. However, the OG group exhibited a substantially prolonged postoperative stay, and no significant variations were observed in the re-intervention rate. In the OG group, mortality and intensive care unit utilization were substantially elevated, reflecting the preoperative impairments that primarily affected patients treated with an open approach.

Although there is substantial evidence in favor of laparoscopic repair, the determination of when to switch to open surgery remains a contentious issue [22]. The extent of the ulcer is a critical determinant in the decision to convert to an open surgical approach. Although there is no universal agreement on the precise diameter required for conversion, laparoscopy can readily repair perforations less than 10 mm in diameter. On the contrary, more substantial perforations may give rise to infiltration of neighboring tissues and fragility, thereby complicating the process of repair [23].

One potential intermediate framework to adhere to is the guidance provided by Bertleff and Lange [24]. On the basis of a comprehensive review of the literature, these authors reached the conclusion that laparoscopic procedures should be avoided in patients who are at least 70 years old, have a Boey risk scale score of three, or have experienced symptom evolution for a duration exceeding 24 hours. In the 1980s, however, this score was intended to determine which patients required a definitive surgical procedure for the ulcus and which could benefit from suture and omentoplasty alone. Certain clinical guidelines continue to advise the utilization of this scale and/or the ASA to stratify risk in these patients, irrespective of the surgical approach taken [25]. Presently, it is also employed to determine the necessity or non-essence of the laparoscopic procedure. Some authors argue that patients with a Boey risk of 3 points should not undergo laparoscopic access, classifying grades 1–2 according to the specific patient type [26]. The attitude towards the indication of the procedure was not influenced by the Boey Risk Score in our series, with the exception of instances involving severe hemodynamic instability.

When a patient has comorbidities, laparoscopic procedures are frequently avoided by surgeons. On the contrary, some scholars advocate for its initial administration, even in patients at high risk [27,28]. However, there appears to be a consensus regarding the avoidance of laparoscopy in patients exhibiting hemodynamic instability [30]. Some risk scales incorporate the period between the perforation and the operation, which has been identified as a critical mortality risk factor [29]

It is important to acknowledge that there are currently no clinical trials or meta-analyses of clinical trials that have identified substantial disparities in mortality rates between laparoscopic and open procedures [30,31].

Conclusions

In conclusion, we assert that the laparoscopic suture of the perforated Duodenal ulcer is a viable and secure technique comparable to the open approach, offering notably more benefits, most notably a reduction in complications.

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